scale manufacturing process is employed. The additional steps of attaching each individual baffle to each individual camera module associated therewith is time-consuming and complicated and, thus, another disadvantage of known modules and manufacturing processes.

[0015] EP 1 434 426 discloses a wafer-scale manufacturing method for integrated camera modules in which an intransparent iris film comprising holes is deposited as a top layer on a wafer from which later individual camera modules are diced. The iris material is made of a film such as an acrylic film or a polyolefin film, and is bonded to an underlying IR filter plate. Alternatively, the iris material may be formed by printing a light shielding material on a surface of the IR filter or on a lens body. Thus, being very thin, the iris film does not stop stray light from entering the camera at angles that are almost parallel to the plane of the iris film.

[0016] A further disadvantage is that the optical system, or at least the top lens element or the iris layer, is fully accessible via the through hole. This may lead to damage and contamination.

BRIEF SUMMARY OF THE INVENTION

[0017] It is a further object of the invention to provide an integrated optical device that can be manufactured in a mass production process at low cost, and a corresponding manufacturing process.

[0018] It is a further object of the invention to provide a wafer scale package comprising a plurality of generally identical camera or optical device modules.

[0019] It is a further object of the invention to provide a sunshade plate with a plurality of sunshade elements and a corresponding manufacturing method.

[0020] These objects are achieved by a a method for providing a sunshade plate, a wafer stack, an integrated optical device and a sunshade plate according to the corresponding independent claims. Preferred embodiments are described in the dependent claims and the description and are shown in the drawings.

[0021] The method for providing a sunshade plate is part of a method for fabricating an integrated optical device by creating a wafer stack by stacking at least a top wafer carrying as functional elements a plurality of lenses on at least one further wafer comprising further functional elements, and separating (dicing) the wafer stack into a plurality of integrated optical devices, wherein corresponding functional elements of the top and further wafer are aligned with each other and define a plurality of main optical axes. The method for providing a sunshade plate as part of an integrated optical device comprises the steps of:

[0022] providing a sunshade plate comprising a plurality of through holes, the through holes being arranged to correspond to the arrangement of the functional elements on the top wafer;

[0023] stacking the sunshade plate on the top wafer, with the through holes being aligned with said main optical axes.

[0024] This allows one to provide, after dicing, a complete integrated optical device module which includes a sunshade. No further steps for adding a sunshade are required. The optical device may comprise an imaging chip, making it an integrated camera module.

[0025] In a preferred embodiment of the invention, the method comprises the further step of stacking a transparent cover plate on the sunshade plate prior to cutting the wafer stack into individual optical devices. As a result, the integrated camera module also comprises a protective cover, and the camera module may be installed in a consumer product such as a mobile phone without the need for a protective plate being mounted on the camera or being provided as part of the housing of the consumer product.

[0026] In the above method, the step of stacking usually includes gluing or bonding the layers being stacked together, e.g. by means of an adhesive. The wafer stack constitutes a wafer scale package.

[0027] A single integrated camera module is manufactured from a wafer stack or wafer package by separating (dicing or cutting) said wafer stack into a plurality of integrated camera modules.

[0028] Further preferred embodiments are evident from the dependent patent claims. Features of the method claims may be combined with features of the device claims and vice versa.

BRIEF DESCRIPTION OF THE DRAWINGS

[0029] The subject matter of the invention will be explained in more detail in the following text with reference to preferred exemplary embodiments which are illustrated in the attached drawings, which show schematically, in

[0030] FIG. **1** an elevated view of a sunshade plate;

[0031] FIGS. **2** and **3** lateral cut-away views of wafer stacks with a sunshade plate; and

[0032] FIGS. **4** and **5** lateral cut-away views of integrated camera modules.

[0033] The reference symbols used in the drawings, and their meanings, are listed in summary form in the list of reference symbols. In principle, identical parts are provided with the same reference symbols in the figures.

DETAILED DESCRIPTION OF PREFERRED EMBODIMENTS

[0034] FIG. **1** schematically shows an elevated view of a sunshade plate. The sunshade plate **1** is wafer-sized and comprises a plurality of through holes **6**, typically arranged in a grid or array. The through holes **6** extend from a top surface **11** to a bottom surface **12** of the sunshade plate **1** and preferably are conical in shape.

[0035] FIGS. **2** and **3** show lateral cut-away views of wafer stacks **8** with a sunshade plate **1**. A wafer stack **8** comprises, from top to bottom, a sunshade plate **1** stacked on a top wafer **2** carrying functional elements, for example, a first lens **9***a* and second lens **9***b*. Alternatively, the top wafer **2** may carry only lenses on its top or only on its bottom surface. The lenses may be fabricated on the top wafer **2** by means of a replication process, or may be shaped into the top wafer **2** itself. The top wafer **2** is stacked on a further wafer **4** from which it may be separated by a spacer wafer **3**. The further wafer **4** carries, as further functional elements, imaging or camera chips **9***c*. Each camera chip **9***c* is aligned with a corresponding lens or set of lenses **9***a*, **9***b*, thus forming, together with the surrounding structural elements **2**, **3**, **4** an integrated camera. Each such integrated camera or integrated optical device defines a main optical axis **14**. FIG. **3** shows a different embodiment from that of FIG. **2**, in that it additionally comprises a transparent cover plate **5** stacked on the sunshade plate **1**. Further embodiments may comprise further layers of e.g. lenses arranged between the top wafer **2** and the further wafer **4**.